MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXXIV. *December* 12, 1873. No. 2.

PROFESSOR CAYLEY, F.R.S., President, in the Chair.

John Berger Spence, Esq., Erlington Hall, Manchester;
Dr. Robert Brown, Birkenhead College;
Prof. W. K. Clifford, M.A., University College, London;
Josh. Hough, Esq., B.A., Rossall School, Fleetwood; and
John Thos. Seccombe, Esq., M.D., King's Lynn,

were balloted for and duly elected Fellows of the Society.

The New Savilian Observatory for Astronomical Physics at Oxford.

The establishment of an Observatory for Astronomical Physics in one of our most ancient seats of learning, cannot fail to be a matter of great interest to the Members of the Royal Astronomical Society. Under this impression it is proposed to give some account of the circumstances which ultimately led to the undertaking, and of some of the objects which it is hoped will be realized thereby.

The Savilian Professor of Astronomy in Oxford, shortly after his appointment, conceived it to be his duty to lay before the proper authorities in the University, the importance of being furnished with instrumental means adequate to the instruction of his class, and for the purposes of original research. The formal application was made to Convocation in March of the present year; when the University, with great, but by no means unusual liberality, voted a sum of money sufficient for the purchase of a Refracting Telescope of 12¼-inches aperture, and for providing a suitable building to contain it. It was contemplated

that this great telescope should be furnished with every appliance which experience had proved to be conducive to the requirements of modern research, and to the saving of physical labour in the use of the instrument. These conditions Mr. Grubb of Dublin has undertaken to fulfil in the terms of his contract with the University; and, judging from what that artist has already performed, no doubt need be entertained that all proper expectations will be realized.

Within the official lifetime of the present Astronomer Royal, an aperture of even* five inches for a refracting telescope, was a circumstance of extreme rareness, if not utterly unknown; such, however, has been the advance both in the manufacture of optical glass, and in the construction of telescopes, that no delay or difficulties were apprehended in procuring an instrument of the comparatively large dimensions referred to.

The Professor and those with whom he acted felt, at the time, that by the acquisition of this noble instrument, at all events the foundation was laid for eventual astronomical arrangements in the University of a far more extensive nature, but they resolved to wait patiently for some suitable, though it might be distant, opportunity for again pressing the claims of this particular branch of science. Had this been all that had transpired relating to the progress of Astronomy in Oxford, probably it would not have been thought desirable to trouble the Royal Astronomical Society with any formal account beyond a brief and passing notice of the liberal provision which the University had thus made for the scientific advantage of its students.

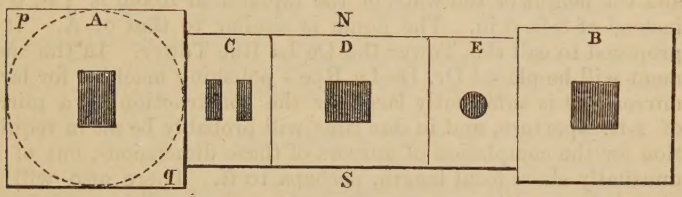
Very shortly, however, after the above arrangements had been completed, Dr. Warren De La Rue, on hearing of the generous disposition of Oxford towards a science which had so successfully occupied a large portion of his life, offered to present the University with his far-famed Reflecting Telescope and the greater part of the contents of his Observatory, on the sole condition that they should be usefully employed. Unfortunately, it was the failure of his eyesight which was the proximate cause of our late President's desire thus to transfer his instruments from Cranford to Oxford: fortunately, this transfer could not be effected before their owner had made, through many years, the noblest use of instruments, which, as he says, "were constructed from his own drawings, and by the hands of his own engineers." There was also a certain gracefulness in thus offering to Oxford a magnificent telescope, for the scientific application of which, the University had recently conferred upon him the high distinction of an Honorary Doctor's degree.

Here, then, there seemed to be presented a fitting opportunity for at once establishing at Oxford a complete Observatory for

* There is a very interesting account of the difficulties which up to 1826 beset the construction of object-glasses beyond the aperture of four inches, in the *Memoirs* of the Royal Astronomical Society, vol. 2, page 507.

the new science of Astronomical Physics, which, under other circumstances, might not have been realised for years. A Committee of Scientific Professors was appointed for the consideration of the subject; and after much and most careful consultation, they recommended the University to accept the munificent gift, and to provide the pecuniary means both for housing the instruments, and for skilled assistance for the Professor in the use of them. The University, acting in the same spirit of liberality which has for many years characterised their dealings towards science, and notwithstanding their grant of £2,500 in March, again added in the month of November a still further sum, adequate for the purposes described.

The annexed diagram, though not intended to represent the architectural features of the building, will sufficiently well explain its general plan.



At A is a square tower, with rustic abutments at the angles, each side being 21 ft. 6 in. clear, inside. It consists of three floors. First, a basement floor, 3 ft. 6 in. below the level of the ground, and 9 ft. 6 in. high. There are windows north and south. Above this is a Computing Room, 12 ft. high. Thirdly, this is surmounted by the Equatoreal Room, destined to contain the great Refracting Telescope, now in course of construction by Mr. Grubb. The walls of this room are 8 ft. 6 in. high from the floor to the bottom of the shutter, and then comes the Revolving Dome, to be described hereafter.

The spaces *p* and *q* between the square walls of the Tower, and the cylindrical skirting of the Equatoreal Room, furnish convenient balconies for the observations of shooting stars and other phenomena in the open air. These balconies are approached from the Equatoreal Room through glazed doors, which will furnish sufficient light in the daytime. The pier for the telescope is built on a foundation of concrete, 9 ft. long, 7 ft. wide, 4 ft. 6 in. deep, and tapers off to 4 ft. 6 in. by 3 ft. This Tower will probably be designated the Savilian Tower. C, D, E, represent a corridor about 40 ft. long and 13 ft. wide. This corridor is to contain two instruments which have already been in use for the instruction of the Astronomical Class in the University. First, there is a basement floor, uninterrupted by divisions, and, similar to that of the Savilian Tower, 9 ft. 6 in. high. Above this is the floor for the instruments, on a level with the floor of the computing room of A. C will contain a Transit

Instrument, the aperture of which is 4 in., and focal length 5 ft.; of course there is also its clock. E will contain an Altazimuth Instrument, by Troughton and Simms, with 18-in. circles; it will be fixed in the meridian, and serve as a Transit Circle, for the instruction of the students. Each of the rooms C and E is 10 ft. long, 12 ft. high. D is a room 18 ft. long, and is intended to contain one of Dr. De La Rue's reflecting telescopes mounted in Altazimuth fashion: aperture 13 in., focal length 10 ft. This instrument will command about one hour on each side of the meridian, and uninterrupted sweeps from the North and South horizon to the zenith. It will be applied chiefly to Zone work; and inasmuch as its optical capacities are of the highest class, it will occasionally serve for the students, in the scrutiny of celestial objects. B is a tower similar in all respects to the Savilian Tower, except that the side of the square is 18 ft. 6 in., and the height of the walls of the Equatoreal Room is 3 ft. 6 in. instead of 8 ft. 6 in. The dome is similar to that of A. It is proposed to call this Tower the De La Rue Tower. In the basement will be placed Dr. De La Rue's polishing machine for large mirrors; it is sufficiently large for the construction of a mirror of 2-ft. aperture, and in due time will probably be set in requisition for the completion of mirrors of those dimensions, but of an unusually short focal length, perhaps 10 ft. There also will be placed, Foucault's apparatus for testing the qualities of mirrors and object-glasses. The basement also permits the admission of a beam of sunlight, nearly 80 ft. long; at a window on the east or west side may be placed a Heliostat, on a small stone balcony provided for the purpose. Most of the windows throughout the building are furnished with similar stone balconies, on which instruments may be placed. The first floor of the De La Rue Tower is subdivided into a small room for Photography and a room for the Professor. The Revolving Domes are peculiar in their construction. Inasmuch as by the great liberality of the University, permission has been given to place this Observatory in the most convenient position within their beautiful Park,* it was thought proper to consider the architectural character of the building, at any rate to the small extent permitted by the astro-

* The ground for this Park, consisting of about sixty acres, was purchased and laid out by the University, and then, with admirable liberality, thrown open to the public. The situation of the new Observatory is remarkably fortunate, and free from any injurious obstruction to the view in every direction. Nevertheless, it lies within an easy distance from and communicates with the University Museum, where are to be found the Lecture Rooms and Laboratories of the various scientific Professors. This Museum, again, is another instance of the munificence of the University, in providing at vast cost for the wants of her students in the natural sciences. Should the University see fit to assign, as is proposed, a portion of the Park contiguous to the new Observatory for the purposes of a Botanic Garden, then, this remarkable aggregation of appliances for every branch of Natural Philosophy, round a common centre, will form an arrangement, which for compactness and completeness has no present rival in the world: a monument and a pledge of the generous care of a true Alma Mater.

nomical exigencies of the case. With this view the form of a lofty, truncated Dome was selected for the revolving roofs, rather than the usual and convenient form of a drum. This necessitated difficult and unusual contrivances for the shutters. They are formed of revolving corrugated steel, extending from the bottom of the dome to about 2 ft. beyond the zenith. The domes revolve on a modification of a Smeaton's live-ring, consisting of twelve wheels. The framework of the dome is of light wrought-iron ribs, braced together with a lattice-work of strong wire; on this lattice-work strong canvas is quilted, and this is again covered with layers of felt and sail-cloth painted. External ribs will run down the roof from top to bottom. The domes are moved from the inside, by means of a large wheel having an India-rubber tire, pressed down on the kerb with any suitable pressure by means of a graduated spring, and turned round by an endless cord. There is also a special contrivance for keeping out the wind. The horizontal truncated top of the dome is surrounded by a light ornamental cresting or balustrade to conceal the box which contains the revolving steel shutters. The opening of the shutters is 3 ft. 6 in. wide.

It is part of the plan, that a Board of Visitors should be appointed for this Observatory, and their Report is annually to be laid before Convocation. This annual Report will, no doubt, find its way into the great Commonwealth of Science, and thus tend to awaken fresh sympathies, and to enhance the general respect for the University far beyond the precincts of Oxford.

No reference has, so far, been made to the Radcliffe Observatory, which has long occupied so eminent a position in the Astronomical Republic. The impression generally prevails that this Observatory is connected with and is under the control of the University of Oxford. Such, however, is not practically the case. The Radcliffe Observatory was founded, exactly a century ago, by the Trustees of the Radcliffe estates, who are not necessarily officers of the University. It originated at the instance of the Savilian Professor of Astronomy of that day, who failing to obtain astronomical instruments from the University, successfully applied for that purpose to the Radcliffe Trustees. The result of that wise and liberal disposition of their funds has been the establishment of an Observatory, which under its last two directors, Mr. Johnson and the Rev. R. Main, has, after Greenwich, proved itself to be second to none for the accuracy and value of its observations. The Savilian Professors are, by the Statutes of the University, no longer permitted to hold the office of Director of the Radcliffe Observatory. It is probable that the Radcliffe Observatory may continue in its sphere of usefulness within the limits of the old astronomy, while the new Observatory will strictly confine itself to the more recent branches of Astronomical Physics. Each may thus assist and illustrate the other. Without the hearty co-operation of Mr. Main, and indeed without the loyal and intelligent zeal, and unanimity of the other scientific

Professors, the establishment of the new Savilian Observatory would have been an impossibility in Oxford.*

C. PRITCHARD,
Savilian Professor of Astronomy.

Oxford, 1873, *December*.

* An Astronomical Library will be a necessity for the complete equipment of this new institution. The Professor will gratefully accept and acknowledge assistance therein from the various Observatories and learned Academies of Europe and America.

On the probable Variability of some of the Red Stars in Schjellerup's List, published in the Astronomische Nachrichten, No. 1591. By J. Birmingham, Esq.

(*Communicated by the Rev. T. W. Webb.*)

I find that the magnitudes of several stars in the above list now differ considerably from the magnitudes recorded, while, at least one star—No. 252—seems to have quite disappeared.

This star was twice observed by Sir John Herschel, and noted, in the Appendix to the *Cape Observations*, as "extremely intense ruby" and of the 8·5 magnitude. It does not appear, however, in the *Bonn Catalogue*.

My first search for it was in July 1872, when I failed to see it, and I was equally unsuccessful in several searches up to a recent date. In October of the present year (1873) I wrote to the Rev. Mr. Webb requesting him to look for it; but to him, and also to Mr. Lynn and other observers at the Royal Observatory, Greenwich, it was invisible. We are, therefore, presented with two hypotheses: either the star must be a variable, or Herschel committed a mistake in his observations. It may be remarked that there is a star near the place of 252, well agreeing with Herschel's description of the latter. The former is No. 251. It was observed by Bessel as red, and rated by him of the 8th magnitude. The positions of both for 1872 are as follows:—

	R. A.			Decl.		
	h	m	s	°	′	″
251 . . .	21	37	59;	+ 37	25	50
252 . . .	21	39	4;	+ 37	16	38;

showing a difference of over 1 minute in R.A. and 9′ in decl.

The grounds, therefore, for any suspicion of a mistake on the part of Herschel might be said to be, the proximity of the places of the two recorded stars, with their similarity of appearance as described, and the absence of 252 from the *Bonn Catalogue*.

I am not aware whether the red stars in the Appendix to the *Cape Observations* are to be considered as discoveries of Sir John

Herschel, or not. If he did not confine the list to his own stars, he would naturally include Bessel's very remarkable star in his observations; and, as he records only one red star in the locality, it would, on the foregoing supposition, add to the cause of suspecting that there was no second similar object about that place after all.

But how can we imagine that if Herschel's observations refer to Bessel's star, they would lead to results which must be considered very erroneous for an observer of his capability, particularly when he had Bessel's position available to check his work? And even if he had no such check to assist him, if he was ignorant (which is scarcely possible) of Bessel's observation, and viewed the star as a new one discovered by himself, still it would be most difficult to believe that he could commit such mistakes in his measurements. On the supposition that Herschel intended merely to give a list of his own red stars, there seems, in fact, to be no substantial ground for concluding that he did not see two pretty near each other, though he noted only one of them as a new discovery, and positioned it accordingly. The fact that neither Bessel nor Argelander seems to have noticed Herschel's star might be explained by the same variability that has caused its recent disappearance; but its invisibility to all observers except Herschel would seem to exclude it from the class of regular variables, as so many coincidences of minima would be unlikely to occur. It might, more probably, be one of those wonderful stars which have been observed only in a single brief period of extraordinary lustre. But whatever view may be taken of the matter, it is certain that no star can now be detected in the position of No. 252 in Schjellerup's Catalogue. I may add, that it is only one of many in that list that I have failed to find; but I bring it alone under notice as its non-appearance has been confirmed by observers about whose accuracy there can be no question.

I have seen several instances of apparent change of magnitude or colour among the stars of the same Catalogue, but I will here mention only two in which my observations have been amply verified.

No. 91 is described as very red, and of the 7·3 mag., but on February 1, 1872, it appeared to me as scarcely tinged with red, and from the $7\frac{1}{2}$ to the 8th mag. This observation was confirmed by Mr. Knott, who gauged it 7·5 to $7\frac{3}{4}$, and described it as "not a decided red, but rather golden with ruddy cast." On January 24, 1873, it appeared to me larger, and of a pale but a decided red. I then estimated it at 7 to 7·5 magnitude. In the case of this star the differences in the observed magnitudes may be within the limits of ordinary error of observation; but I feel pretty certain that at least changes in colour have taken place, and this, I should say, supports the probability of change in magnitude.

The second instance of change to which I will now refer, is found in No. 241. This is one of Lamont's stars, and is described as "rubra, 8·5 m."; but on September 24, 1873, it appeared

to me an orange star, not less than from 6 to 6·5 magnitude. Since then I estimated it on different occasions as a little above or below those limits; but the differences are too small to be received as certain without actual measurement. The question of variability depends, therefore, on the accuracy of the original record. My observations have been borne out in the main by Mr. Lynn and other gentlemen of the Royal Observatory, Greenwich, who found the star in last October to be from 6 to 6·5 magnitude.

On the Double Star ν Ceti (*Struve* 281). By Capt. W. Noble.

Unless Admiral Smyth was more than ordinarily inaccurate in his description of this star, which is the 102nd object in the *Bedford Catalogue*, its minute companion must have increased most notably in magnitude since the date of the observation of it which he there records. (*Celestial Cycle*, Vol. II., p. 64.) Describing the aspect of this asterism at the epoch 1833·88, he says,—speaking of the little star 6″ distant from *ν*, "this very delicate object is one of those marked by Σ 'difficilis;' and not without reason, for the *comes* can only be seen by glimpses on ardent gazing." It must be borne in mind that this account has reference to the appearance of the object under discussion in the late Admiral's 5·9-inches Tulley achromatic.

On page 211 of the 2nd edition of that most invaluable little book, Webb's *Celestial Objects for Common Telescopes*, I find its author saying with regard to the little companion, "Sm. saw this as a glimpse star. I found it easy with $5\frac{1}{2}$ in 1861."

Now, on the night of Monday last, December 8, while examining the heavens for another purpose, I got *ν Ceti* into the field of view of the telescope, and, to my surprise, saw its companion instantly and steadily with a power of 154. Nay, so comparatively conspicuous was it, that, having viewed it under the higher power, I could see it perfectly well afterwards with one of 74.

My Ross object-glass has, as is pretty well known, an aperture of 4·2 inches only, while that of the Bedford Equatoreal was, as I have previously mentioned, of 5·9 inches in aperture; so that the ratio of the area of my object-glass to that of Admiral Smyth is only $\frac{17{\cdot}64}{34{\cdot}81}$, or roughly, one-half; and yet I can see at once and without difficulty, a star which he could only perceive "by glimpses on ardent gazing." It seems then to me an obvious inference that the object in question must be a well-marked variable.

Forest Lodge, Maresfield, Sussex,
1873, *December* 11.

The November Meteors. By the Rev. S. J. Perry.

A constant watch for meteors was kept up during the whole night from November 11, until midnight of November 15. On the first two nights the sky was generally about half covered with cloud, on November 13 seven-tenths were obscured, and it was completely overcast on November 14. The moonlight also interfered a good deal in the early hours, but 91 meteors were observed. Of these 14 had trains, and none were coloured. The times of greatest frequency were from 9h. to 12h. on November 11, from 9h. to 16h. on November 12, and from 9h. to 12h. on November 13, the numbers being respectively 22, 37, and 13. The paths were all noted, and but few were found to belong to the stream of the Leonides.

On November 27, between 8h. and 10h., six meteors were seen, three of which were of the 1st magnitude; but during the remainder of the night only two others were observed, although the amount of cloud was seldom more than three-tenths until 2 A.M. on November 28.

Stonyhurst Observatory,
1873, *December* 11.

Suggestions for a Search for the Small Stars near Uranus, which Sir W. Herschel may have observed as Satellites.

By A. Marth, Esq.

(*Extract from a Letter to Mr. Lassell.*)

It may perhaps be worth while to call the attention of those observers who have the opportunity of using sufficiently powerful telescopes, to the favourable chances they may have during the present apparition of *Uranus* of contributing something towards the decisive settlement of the question respecting the existence of Sir William Herschel's additional satellites of the *Georgium Sidus*.

Though there is no positive evidence available in proof of the real existence of these satellites, and though there can be no doubt that Herschel has not been sufficiently cautious in assuming their existence from the very questionable negative evidence at his disposal, it is only right and due to his memory, that this evidence should be fully sifted and his mistaken inferences properly traced to their true sources. You are aware, that, for years past,

I have been desirous and ready to do this, whenever I should get a fair opportunity; but such an opportunity I have not got. The search for the little stars, which Herschel must have mistaken for satellites, may of course be undertaken at any time and by any observer, who can make use of a powerful telescope in a suitable atmosphere, and who will take the necessary trouble. During the present apparition of *Uranus*, however, observers may take part in the search with no more trouble than that of making careful eyedrafts of the groups of stars in the neighbourhood of the planet itself. For, during the next months, the geocentric place of *Uranus* in the heavens will be only some twenty seconds south of that in which it appeared in 1790 at a (less than) three days' later date, so that the planet in its retrograde course will pass on the nights of January 15 and February 6, 1874, the same stars which it passed on the evenings of January 18 and February 9, 1790, and some of which were then supposed to be additional satellites. It seems certainly desirable that the opportunity for recovering these little stars, and also for ascertaining the effect of the neighbourhood of the planet upon their visibility, should not be allowed to slip away unused; and I therefore suggest to you to call attention to it at the next meeting of the Royal Astronomical Society. It may be well to state expressly, that the telescope employed by Herschel in these observations was his 20-foot reflector, so that there are telescopes enough in the world which ought to be capable of showing what he has seen. With which of them, however, *Oberon* and *Titania* may be really observed, and which of them may be capable of at least showing glimpses of *Ariel* and *Umbriel*, is a question, to which at present no answer can be given, but which might be fairly answered, if observers would be good enough to make simple sketches of the groups of stars surrounding the planet and along its track, at every favourable opportunity during the present apparition, and to send their sketches or copies to the Society. I should be most willing to subject these sketches to the needed examination, and to compute the necessary ephemerides of the known satellites. However, in order to leave observers entirely unbiassed, it will be better not to publish ephemerides before-hand. As regards the two faint satellites, *Ariel* and *Umbriel*, it is not likely that they could be seen with any telescope which does not readily show the satellite of *Neptune*, when it is not too far from its greatest elongation; in fact, they do not seem ever to have been really observed except with your own instruments. But I need not say more on the subject now.

A Third Catalogue of 76 New Double Stars, discovered with a 6-inch Alvan Clark Refractor. By S. W. Burnham, Esq.

(*Communicated by Mr. Dunkin.*)

The accompanying list is the result of a search for new double stars since the preparation of the Catalogue in the *Monthly Notices* for May 1873. The 6-inch Alvan Clark refractor previously described has been used exclusively. In the beginning I limited the distance of doubles to be noted as new to 10″. A few exceptions were made in the case of prominent stars, and where additional companions to well-known doubles were found. In the present observation, I have rarely paid any attention to double stars where the estimated distance exceeded 5″, rejecting also faint pairs of below the 9th magnitude unless connected with a brighter star. With Struve's limit of separation, 32″, a very large number of uncatalogued double stars could be easily found; and if, in addition, faint pairs were noted like those comprising the larger portion of the Catalogues of Sir John Herschel, the number which could be added would be still greater, and only limited by the time necessary to observe their places.

Most of the following are sufficiently close and difficult to be interesting. The distances of fifty-five are within 2″, and of that number about one-fourth will not exceed 1″. The power used almost constantly has been 212; and I believe every double has been discovered, or suspected with that eye-piece, a higher power being used only on very close objects. My next lower power is 125; but it is of no use on really difficult double stars of the class sought for; and my experience has been that when the higher powers cannot be used to advantage, it is in vain to look for anything new.

During the period covered by these observations I noted, altogether, as being possibly not already known, 199 double stars, with an approximate determination of the places. Of this number, 76, forming the present Catalogue, were ascertained to be new. The remaining 123 are distributed among discoverers as follows:—

Struve . . .	75
Otto Struve . .	35
Herschel I. . .	5
Herschel II. . .	2
Alvan Clark . .	3
Dawes . . .	1
Burnham. . . .	2
	123

From this it will be seen that rather more than one-third of the stars entered really proved to be new. Of course, it will be understood that this is only a small portion of the number picked up; but my practice has been to give no attention to stars unless at least moderately difficult under average atmospheric conditions. Occasionally, perhaps, if the place had been determined the double might have been found to be new, but the time saved more than compensates for the probable omissions. In my earlier observations, the proportion of new objects was very much less; but practice has enabled me to know better what to look for, and to decide with some certainty whether or not the star observed is likely to be new; and I think this ratio would now hold substantially good. The value of the various double star catalogues will be seen from a comparison of the number of double stars found and identified in them. *Mensuræ Micrometricæ*, which contains six times as many stars as Otto Struve's Catalogue, furnishes but twice as many, while in all the rest of the works on this subject, embracing between 4,000 and 5,000 stars, there are but eleven identified.

My observations have been largely south of the zenith, and particularly in the vicinity and south of the equator, and this will account for the undue proportion of southern stars. More attention recently, however, has been given to regions further north, with the result of discovering some very interesting pairs. A more careful examination has also been given to previously known doubles encountered from time to time, and in several instances the principal star has been found to be again closely double. Perhaps the most prominent of these, although not the most difficult, is *β Delphini*. As this star has been observed by Struve, both Herschels, Smyth, Dembowski, and others, without the duplicity of the bright star being detected, there is a possibility of its having opened within a few years. Although by no means a severe test for a 6-inch aperture, it is still difficult enough to have been missed, unless very carefully examined. This is not the case with Σ 2793; and it seems impossible for Struve to have overlooked it, unless much closer then than now. 51 *Aquarii* is closer and much more difficult than either. In this part of the heavens generally, there is a great scarcity of close doubles in *Mensuræ Micrometricæ*. Several have been found, given in this and the preceding lists. The close pair of H. 2867 is an exceedingly difficult object, and has no counterpart among Sir John Herschel's double stars. It is a remarkable fact, and hardly accounted for by the sweeping power employed, that the seven catalogues of Sir John Herschel, which, with *Cape Observations*, comprise more than 3,800 double stars visible in this latitude, do not contain a single very close double star, and but six where the estimated distance is down to 1″. How comparatively little there is in them likely to receive any attention in searching for new objects with the limit I have adopted as to distance and magnitudes, will be apparent from an inspection of

the statement above, giving the original observers of the double stars noted from time to time, and found to be already known.

I would call particular attention to *ν Scorpii* (No. 120), which I have very little doubt is an exceedingly close and difficult double star. I examined it several times under the most favourable circumstances, but could not get rid of an apparent elongation of the principal star in a direction nearly north and south. A power of 410 was used, and the utmost care taken in focussing. *β Scorpii* is an admirable object for this purpose, having about the same declination, and also a companion in the same general direction as the more distant companion to *ν Scorpii*. *β* was always seen with a perfectly round and sharply defined disk, and turning the instrument at once on *ν*, it did not seem possible that the slightly wedge-shaped elongation could be an illusion. Not being able to settle the question positively with my aperture, I requested Professor C. A. Young to examine it with the splendid 9·4-inch Clark refractor of the Dartmouth College Observatory, and he kindly did so. He informs me that he observed it on several occasions, generally under unfavourable conditions; but the last time the air was pretty steady, and while the elongation might be due to atmospheric dispersion, he was rather inclined to think it was double, although he could not even notch it. In the mean time I had tried it again on a number of superb nights, but with no further result than tending to confirm the previous suspicion. From its great southern declination it would necessarily be a very difficult object in this latitude; and it is only when the air is unusually steady that a sufficiently high power can be used to show it. I trust that some observer in the Southern Hemisphere will give this star a careful examination. I shall certainly be much disappointed if it prove to be single. As a wide pair this star is HV. 106 (= Sh. 220 = Σ C.P. 509). Jacob at Madras in 1847 found that the companion was also double, and that is now a very easy object. Should the principal star also prove to be double, it will make by far the most interesting known quadruple in the heavens.

The Nebula given at the end of this Catalogue may possibly not be new, but I have not been able to find it in any of the works I have access to. At the first glance it was taken for a close double companion to Argelander's star. With a large aperture, it will doubtless be found to be a very interesting and curious object.

The distances and angles are in all cases estimated. The numbers are continued from the last Catalogue.

Chicago, U.S., 1873, *November* 12.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
107	Arg. (+62°) 93	0 24 28	+62 41	360	2	9, 10	Sept. 8	A faint and not very interesting pair. About 25′ *n* of *κ Cassiopeiæ*. One of four stars in the same field, forming an irregular line.
108	Arg. (+62°) 107	0 27 43	+62 15	10	5	7½, 10	Sept. 8	A third star at 240° 40″. It is 1ᵐ 22ˢ *f κ Cassiopeiæ*. An 8 m. star in the field *s p*, has a 15″ companion.
109	Ceti 91 A and B C	0 30 26	−17 37	355	100	7, {	Oct. 23	A distant double companion.
	B and C	...	...	340	5	10, 10		
110	Ceti 187	1 14 4	−16 32	25	1·8	7, 8	Oct. 28	An elegant but easy pair.
111	Anonyma	10 45 10	− 8 28	360	1·8	9½, 9½	April 25	Small and rather difficult pair, some distance *s f* 41 *Sextantis*. It is 13ˢ *f* Weisse x. 791, from which its place is determined.
112	P. xii. 243 A and B	12 54 46	+19 1	345	155	6½, {	June 3	A pretty double companion to a bright star in *Coma Berenices*. Erroneously called Weisse xii, in Heis' Catalogue.
	B and C	...	...	290	2	8, 9		
113	Arg. (+12°) 2597	13 23 9	+12 6	210	1·6	8½, 12	June 3	I have very little doubt of the duplicity of this star, although it was never well seen, and if double is one of great difficulty. It is 39′ exactly *n* of 71 *Virginis*.
114	Weisse xiii. 438	13 28 0	− 8 0	130	1·8	8, 8	May 30	A fine and not difficult pair, about 1° *s p* 81 *Virginis* (Σ 1763). The *s f* star of a pair in the finder.
115	L. 25365	13 39 24	+10 29	220	1·3	8, 12	June 1	An excessively difficult and unequal pair in *Virgo*; seen well only by the most careful preparation and attention.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
116	L. 26177	14 13 3	− 13 9	280	2·5	8, 9	May 15	A pretty little pair 20′ *n* of λ *Virginis*; very easy.
117	L. 26481	14 24 41	−15 5	90	2	8, 9	May 22	Another pair in *Libra* similar to the last.
118	No. 4, Z. 205	14 47 5	−16 0	300	1·7	9, 10½	June 1	A very difficult object, requiring good weather to be well seen. It is $2\frac{1}{2}^{m}$ *f* and 28′ *s* of *a Libræ*. Place from Argelander's Southern Zones.
119	L. 27454	14 59 11	− 6 33	300	1	8, 9	May 4	A fine pair in *Libra* in the vicinity of δ *n f*. It has a minute companion *s f*.
120	*ν* Scorpii A and B	15 5 1	−19 9	360 ?	0·3 ?	4,	June 14	The principal star of this well-known triple strongly suspected to be a very close double. (See further reference in the introduction to this paper.)
121	B.A.C. 5163	15 32 19	−27 16	270	1·5	7, 7	May 30	An elegant pair 2^{m} 55^{s} *f* and 29′ *n* of 39 *Libræ*, and not difficult under favourable conditions.
122	L. 28495	15 32 58	−19 23	210	2	7, 7½	May 31	This very easy pair precedes *κ Libræ* 2^{m} 3^{s}, and is 5′ *s*.
123	No. 25, Z. 245	16 47 29	−21 51	210	2	8, 9	June 16	In *Ophiuchus;* place from Washington Meridian Zones.
124	L. 31224	17 3 59	− 0 37	250	1	8, 10	May 31	A very difficult pair in *Ophiuchus n f* a 6 m. star (B.A.C. 5774), but, finally, perfectly seen.
125	P. xvi. 311	17 4 43	−26 53	90	1·5	7, 11	June 13	An exquisite pair 3^{m} 16^{s} *p* the well-known double, 36 *Ophiuchi*, and 28′ 18″ *s*. The colours of the components are strikingly contrasted when the air is steady enough to give a sharp definition; but it is an object of very great difficulty and requires careful attention. This is B.A.C. 5789. There is an 8 m. star nearly north and almost exactly *p* 36 *Ophiuchi*, which may be a very close equal pair.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ′	Magnitudes.	Discovered 1873.	Notes.
126	P. xvii. 43	17 12 53	−17 38	250	1·8	6½, 9	June 15	B.A.C. 5839. Another fine pair in *Ophiuchus*, but comparatively easy. Very nearly visible to the naked eye; rated 6 m. in Lalande, and 5·5 in Washington Catalogue of Stars. A splendid object.
127	L. 31454	17 13 24	−27 13	90	5	8, 10	June 6	The *p* of two small stars 6′ or 7′ apart, and some distance *s f* 36 *Scorpii*.
128	B.A.C. 5879	17 19 33	−26 9	340	4	7½, 10	June 6	This is L. 31668, the declination of which is 4′ 23″ more than that in B.A.C.
129	P. xvii. 100 = B.A.C. 5896	17 21 15	−25 25	100	1·5	7½, 8	June 6	A fine pair *s f* the last; an elegant object.
130	90 Herculis	17 49 22	+40 3	10	1·7	6, 11	June 18	The minuteness of the comparison with its closeness to the principal star makes it tolerably difficult for a 6-in. under ordinary conditions. It is a beautiful pair when well seen.
131	L. 33443	18 3 50	−15 38	270	2	7½, 10	June 16	A pretty pair in *Sagittarius*.
132	B.A.C. 6158	18 4 7	−19 52	60	0·8	7, 7	June 6	An elegant pair about 1° 25′ *n p μ Sagittarii*; perfectly seen with disks just in contact.
133	B.A.C. 6261	18 20 15	−26 42	270	1·8	7½, 7½	July 6	The *p* star of a small equilateral triangle of 7 m. stars, about 1° 20′ *s* of λ *Sagittarii*. The other stars of the triangle have distant companions.
134	Arg. (+46°) 2484	18 22 0	+46 50	140	1·3	7½, 10	June 6	A fine and somewhat difficult pair in *Lyra*. The wide pair 1ᵐ 7ˢ *f* is OΣ 352. The fifth new double star found to-night.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
135	Scutum Sob. 45	18 31 16	−14 6	210	2	7, 15	June 14	One of the most difficult double stars of the kind I have ever found or seen, from the excessive inequality of the components. It requires the utmost care in focussing, etc., to be seen, and is far more difficult than the companion to a^2 *Capricorni*. It was only after repeated examination on the finest nights that I could be sure of the existence of the small star.
136	Weisse xviii. 893	18 37 0	+5 37	10	4	9, 10	Aug. 20	Of no particular interest, 49^s *p* OΣ 361 and 6′ *s*.
137	Weisse xviii. 1503	18 49 47	+37 14	140	1·5	8, 8	June 8	An easy pair, 17^s *p* and 24′ *n* of δ^1 *Lyræ*.
138	L. 36013	19 6 37	−14 39	270	1	7½, 10	Aug. 16	Splendid but excessively difficult pair in *Sagittarius*. A good example of a close and at the same time unequal pair.
139	Aquilæ 59	19 7 11	+16 39	130	0·5	7, 7	Sept. 7	Very close and remarkably difficult pair. It is the *f* star of a wide pair. OΣ 368; a 0″·9 pair in the finder *s f*, is comparatively easy.
140	L. 36185 A and B	19 10 12	−11 11	330	30	8,	Aug. 22	Star in *Aquila* with a faint double companion.
	C	...	...	210	3	14, 15		
141	H. 2867 A and B	19 16 50	+22 17	85	0·4	7½, 8½	Sept. 7	A and C constitute the double star H. 2867, but Sir John Herschel overlooked the duplicity of the principal star. The 15 m. companion is readily seen. The close pair one of the severest tests of the kind in this list. It is L. 36553.
	A and C	...	...	329·5	20±	15		
142	Aquilæ 106	19 21 30	−12 23	145	1·4	7, 7+	June 28	Very easy, but still an interesting pair. It is L. 36712.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.		Discovered 1873.	Notes.
143	L. 37049	19 26 39	+49 15	200	2	8½,	10	June 8	In the finder with *θ Cygni s p*.
144	Arg. (+30°) 3664	19 33 3	+30 5	185	4	9,	9	June 29	In *Cygnus, n p φ Cygni*.
145	L. 37464 A and B	19 36 31	+30 26	280	0·9	7,	10	Aug. 26	A most elegant triple, but the close pair extremely difficult from the great difference in brightness of the stars. This star is about 45′ from *φ Cygni n f*.
	A and C	...	...	175	20		11		
146	L. 37544	19 40 5	−20 10	290	1	9,	11	July 21	In a low power field with *f* (56) *Sagittarii* 43ˢ *f* and 7′ 26″ *s*. It is a very difficult object from the smallness of the stars.
147	Arg. (+31°) 3770	19 42 15	+31 48	285	6	9,	11	Oct. 9	An uninteresting double. About 50′ *s* of H.N. 110, the Decl. of which in Sir John Herschel's Catalogue is 11′ too great. It is identical with S. 726.
148	L. 37779	19 45 27	−10 40	310	1	8,	9	July 21	Another close pair some distance *n f* 51 *Aquilæ*.
149	L. 38105 A and B C	19 52 46	+16 10	280	125	7,		Sept. 19	A companion to the companion; 18′ *s* of 11 *Sagittæ*.
	B and C	...	...	200	2·5	11,	15		
150	Σ C.P. 663 = S. 738 A and B	20 5 56	+33 17	112·2	41·86	8,	8·9	Aug. 17	It is singular that Struve and South should have missed the close star, as it is quite plain with 6-in. South's measures of A and B are given. By reason of the distance it is excluded from *Mensuræ Micrometricæ*. The principal star is Weisse xx. 176–7.
	B and C	...	...	190	2		11		

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
151	β Delphini A and B	20 31 55	+14 11	355·	0·7	3½, 5	Aug. 8	It is somewhat remarkable that this splendid pair should have escaped notice. It has been observed by nearly all the well-known double star observers. With an 11 m. companion at 336°·6, distance 34″·64 (Dembowski 1864·9); it constitutes Σ 2704 (=H. iv. 35). Sir William Herschel added a 14 m. companion at 15″, and both were measured by Smyth. Many of the pairs in this list are far more difficult than the close pair.
152	Cephei 55	20 39 18	+56 57	130	0·4	6¾, 8½	Aug. 8	A very close and excessively difficult pair; a short distance *s p* a 5 m. star (P. xx. 322). A pretty severe test. It is Radcliffe 4932.
153	B.A.C. 7187	20 40 10	−26 51	270	1·5	7, 10	Aug. 4	Fine pair in *Capricornus*, and not very difficult. The wide pair 27′ *s* is H. 5220.
154	Taylor 9641	20 46 6	−16 37	55	2·5	8, 10	Aug. 17	L. 40292. In *Capricornus*, 4ᵐ 52ˢ *p* a 6 m. star (P. xx. 386).
155	Arg. (+50°) 3215	20 48 25	+50 58	40	0·6	7½, 7½	June 13	A splendid double in *Cygnus* 2ᵐ 18ˢ *f* and 30′ *s* of Σ 2732 (= H. ii. 100 = S. 767). Not very difficult as the stars are very nearly equal. The distance may be underrated.
156	Groombridge 3369	20 57 39	+46 6	260	1·2	8, 11	June 28	This very unequal and difficult pair is 29′ *n* of 60 *Cygni* (OΣ 426). There is a minute distant companion north. Place from Radcliffe Catalogue.
157	Aquarii 43 = Σ 2752 A and C	21 0 29	−14 24	90	20	7, 14	Aug. 18	A minute companion three or four times the distance of Struve's star.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.		Discovered 1873.	Notes.
158	L. 40984	21 1 37	+47 19	320	12	8,	16	July 20	The companion only well seen with high powers. It is 37ˢ *p* the supposed new Nebula given at the end of this list.
159	L. 41178	21 6 19	+47 2	330	1·2	8,	10	July 6	The north star of a wide pair 3ᵐ 51ˢ following f^2 (63) *Cygni*. An elegant object.
160	L. 41242 A and B C	21 7 48	+45 13	155	60	8,		July 6	Star with a double companion.
	B and C	...	...	140	2	11,	11		
161	Weisse xxi. 197 A and B	21 10 53	− 5 45	330	90	9,		Aug. 23	Star with double companion; in the finder with 15 *Aquarii*, *n p*.
	B and C	...	...	300	2·5	12,	12		
162	Arg. (+35°) 4461	21 12 14	+35 16	80	1·5	8,	8	June 26	A pretty pair about 50′ *n* of *υ Cygni* (O Σ 433).
163	L. 41386	21 12 47	+11 4	260	1	7,	10	...	A remarkably fine double star in *Equuleus*. The great inequality of the components with their closeness makes it a rather difficult pair. The stars L. 41438 (6½ m.) and L. 41429 (7 m.) do not exist. Probably they are derived from some observation of 41401 and 41386 from which they differ exactly 1ᵐ in R.A.
164	Σ 2793 A and B	21 19 12	+ 8 52	255	0·7	7½,	7½	Aug. 24	The wide pair is Σ 2793, but the principal star is again double. Struve, whose measures of C are given, could hardly have overlooked the close pair if not closer than now. This star is L. 41645.
	A and C	...	...	242·2	26·51		10		
165	L. 41954	21 27 54	− 3 59	180	6	8½,	10	Aug. 3	The *s* and smaller of two stars forming a pair in the finder.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
166	Arg. (+59°) 2396	21 30 17	+59 47	260	1·2	7½, 11	Aug. 4	A very fine pair $2^m\ 35^s$ *f* a 5 m. star (B.A.C. 7495). Difficult except in a very steady air.
167	Cygni 363	21 31 1	+29 31	110	1·5	7, 12	July 6	A most difficult pair from the extreme minuteness of the companion and its nearness to the bright star; a very elegant pair under favourable circumstances. Very much like No. 135, but not so difficult. It is P. xxi. 215.
168	Taylor 10162	21 47 7	−20 35	80	4	8, 9	Aug. 18	L. 42642. Another minute companion *f*.
169	O. Arg. S. 21760	21 50 49	−21 43	280	1·8	8½, 8½	Aug. 18	The *s* star of a wide pair, 95″ apart, is a pretty and not very easy double. A 6 m. star (B.A.C. 7649) follows $1^m\ 13^s$. The 7 m. star $1^m\ 35^s$ *p* is H. 3065, a wide unequal triple. The *p* star of the new double is a little the smallest. Place from the Washington Catalogue of Stars.
170	L. 43158	22 2 31	−19 4	75	2	8½, 8½	Aug. 14	This beautiful little pair is a distant companion to 35 *Aquarii*. P. = 40°; D. = 160″. There is a minute star between it and 35 *Aquarii*. The wide pair in the field *n f* is H. 3092.
171	L. 43350	22 7 51	−21 38	270	10	8, 15	Sept. 30	This star, which is a distant companion to 41 *Aquarii* (H.N. 56), is 10^s *f* and 2′ 44″ *n*, and has a very minute attendant at about twice the distance of that between the components of 41 *Aquarii*. It is spoken of by Webb as a 7 m. star; in Lalande, 9 m.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance est. ″	Magnitudes.	Discovered 1873.	Notes.
172	51 Aquarii = H.V. 95	22 17 52	− 5 27	40	0·5	6, 6	Sept. 15	This star with three very distant companions constitutes the double H.V. 95 (= Σ C.P. 748), but both Herschel and Struve missed the close pair. When first found it was thought to be only moderately difficult, but later observations make it a pretty severe test for a 6-inch.
173	Arg. (+36°) 2776	22 22 23	+56 35	250	2	8½, 12	Aug. 20	A delicate unequal pair in *Cepheus*, 3ᵐ 22ˢ *p* a wide pair (0 Σ 473). There is a 10″ pair of 10 m. stars in the field *p*.
174	L. 43888	22 22 58	−10 17	280	5	8½, 13	Aug. 28	An unimportant pair in *Aquarius*; the most northern of three stars.
175	Arg. (+74°) 970	22 29 49	+74 24	120	1·5	9½, 9½	July 24	An extremely difficult pair found in looking for H. 1761, one of Herschel's suspected doubles. It cannot be that pair, as it differs in R.A. about 12ᵐ, and 9′ in Decl., with an entirely different position angle. I could not find any double in H.'s place. The new pair is 4ᵐ 51ˢ *p* B.A.C. 7907 (6·5 m.) and 21′ *s*.
176	Arg. (+38°) 4842	22 35 54	+38 57	40	1·8	9, 10	Sept. 2	A pretty little pair 1ᵐ 35ˢ *p* and 10′ *s* of the fine pair Σ 2942. The three double stars Σ 2942, 0 Σ 478, and H. 1803 are identical.
177	No. 22, Z. 145	22 45 55	−22 20	280	2	7½, 8	Sept. 8	In *Aquarius*. Place from *Washington Meridian Transit Zones*.
178	Aquarii 252	22 48 57	− 5 38	310	0·6	6, 8	Sept. 8	A splendid close pair in *Aquarius*, and perfectly seen though not divided. This is a naked-eye star, and is P. xxii. 250 (B.A.C. 7986).

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Position est. °	Distance, est. ″	Magnitudes.		Discovered 1873.	Notes.
179	Anonyma	22 55 48	−22 54	115	5	8½,	9½	Oct. 19	An unimportant pair of small stars in *Aquarius*.
180	Arg. (+60°) 2482 A and B	23 2 10	+60 11	200	0·5	7½,	7½	July 27	Another very close and difficult pair (in *Cassiopeia*), with a distant companion. There is also a minute pair in the field *s f*. Σ 2977 is about 36′ north, and OΣ 486 is $3^m\ 44^s$ preceding the new pair.
	A and C	...	...	100	40		10		
181	Aquarius 286 A and B	23 7 31	−14 3	300	1·5	7,	11	Aug. 27	The close pair an exquisitely beautiful object; $5^m\ 15^s$ *p* and 3′ 56″ *n* of the well-known double, 94 *Aquarii* (Σ 2998). The colours of the two nearest are remarkably fine and strikingly contrasted, the primary being reddish. Both companions are difficult in ordinary weather.
	A and C	...	...	230	15		15		
182	Weisse xxiii. 175	23 10 54	−14 27	45	0·8	8,	8	Aug. 27	The *p* star of a small equilateral triangle. It is $1^m\ 52^s$ *p* and 20′ *s* of 94 *Aquarii*. A fine close and rather difficult pair.
—	Nebula	21 2 14	+47 22	...	...	...		July 6	A very remarkable and curious double, or elongated planetary (?) nebula. It is close to a 9·3 m. star, Arg. (+47°) 3289. P. = 245°; D. = 30″. This may have been noted before, but it is not in Herschel's General Catalogue, or Lassell's Catalogue of New Nebulæ. It bears magnifying well, and the elongation could not be seen with less than 400. With a large aperture it would probably be a very interesting object. It is 12″·6 *n* of f^2 (63) *Cygni*.

Observations of the Total Eclipse of the Moon on May 12, 1873. By John Tebbutt, Esq.

The sky, with the exception of a few small hazy clouds on the horizon, was clear throughout the eclipse. I do not remember to have seen the Moon's limb more sharply defined, though the periphery of the shadow was unusually irregular and diffused. The following are the local times of the different contacts, as near as I could fix them :—

	h	m	s	
First contact with the shadow .	7	33	59	Local Mean Time.
Beginning of total phase . .	8	38	49	„
End of total phase . . .	10	8	50	„
Last contact with the shadow .	11	14	14	„

As early as 6h. 45m. the Moon's lower limb was noticed to be less bright than the upper one, but it was not till about 7h. 19m. that the defalcation of light became marked. At no time during the partial eclipse did the limb or the lunar details become undistinguishable in the telescope, and during the whole of the total phase the Moon was plainly visible to the naked eye. About 7h. 54m. the shadow began to assume the usual coppery tint, with the exception of that portion extending inwards about 3′ from the periphery. This portion of the shadow during the partial phase preceding the total immersion, was of a greenish-grey tint. During the total phase the whole disk, excepting that limb furthest from the centre of the shadow, was suffused with a dull red colour, this limb, however, continued of a bright straw colour. At 7h. 51m. the *Milky Way*, with the exception of the more conspicuous portions, such as the nebula about η *Argûs*, was still invisible. The larger Magellanic cloud, however, was faintly perceptible, but the smaller one quite undistinguishable. The *Milky Way* and the smaller cloud were faintly seen by oblique vision at 8h. 3m., but at 9h. 4m. both the Magellanic clouds and *Præsepe* became distinct. Many telescopic stars were occulted during the totality. The following disappearances were observed :—

	h	m	s	
Star 8th Magnitude . .	8	23	51·5	Local Mean Time.
„ 8½ „ . .	8	35	45·3	„
„ 8 „ . .	8	37	5·8	„
„ 8½ „ . .	8	53	59·3	„
„ 9 „ . .	9	11	54·3	„

The last observation was only approximate, as the star was extremely faint. At 9 h. 17 m. houses constructed of dark material and distant more than 200 yards from the Observatory could not be distinguished from the surrounding landscape. With a view to test the intensity of the darkness, I at 9h. 27m.

attempted to read the title page of the *Nautical Almanac* for 1873 in the moonlight with the unassisted eye, but could not at the ordinary reading distance distinguish the separate letters of the words "Nautical Almanac." I did not succeed in doing so till 10h. 19m., or about 10 minutes after the end of the total phase. The letters of the title page down to "with an appendix" inclusive, could be readily distinguished at 10h. 43m., but this was not the case with letters as small as those contained in the words "containing elements and ephemerides." The larger Magellanic Cloud and the brighter portions of the *Milky Way* were barely visible at 10h. 45m. Seventeen minutes later they had quite vanished from view. Three minutes after the time of last contact the whole of the title page of the *Nautical Almanac* could be made out with the greatest ease. During the partial phase subsequent to the total immersion, the edge of the shadow was of a deep grey tint approaching to slate-blue, and the interior part of a coppery colour. The observations of the contacts and occultations were made with a refractor of $4\frac{1}{2}$-inches aperture, and 70-inches focal length, provided with a power of about 55. The instrument is the work of Messrs. Cooke and Sons, of York.

Observatory, Windsor, New South Wales,
1873, *August* 14.

Observations of Jupiter's Third Satellite. By John Tebbutt, Esq.

While engaged on the 1st of April last, with my $4\frac{1}{2}$-inch equatoreal in observing the transits of *Jupiter's* first and third satellites, I was much struck with the appearance presented by the latter body. With a power of 265 on the equatoreal I could see that the satellite was at 7h. $40\frac{1}{2}$m. just within the disk. With the same power I also observed the first and last contacts of the first satellite at ingress. These took place at 8h. $3\frac{1}{2}$m. and 8h. $5\frac{1}{2}$m. respectively, but the planet's limb was at the time ill-defined. Although the third satellite was distinctly visible as a bright spot when just within the limb, it afterwards disappeared, being undistinguishable from the disk of its primary. I now removed the eye-piece and substituted for it another having a power of 180. On looking at the planet at 8h. $15\frac{1}{2}$m., I was surprised to find not only the first satellite visible as a bright spot just within the disk, but also a little in advance of it a round and very dark spot, which from its position I immediately concluded to be the third satellite. Retaining the power of 180, I watched the phenomenon till the satellite completed its transit. The most interesting circumstance is, that the satellite maintained its blackness throughout the transit, and that it was difficult to

decide which was the more intense the blackness of the satellite or that of the shadow of the first satellite, which was projected at the same time on the disk, and therefore admitted of direct comparison. The third satellite was very near the centre of *Jupiter's* disk at 9h. 16¼m. At 10h. 13¾m., and for a long time afterwards, I noticed that the shadow of the first satellite was projected on one of the dusky belts of the planet, and was surrounded with a ring of faint light. This phenomenon was probably the effect of contrast. Considering the transit of a satellite as a dark spot to be of rare occurrence, I immediately called the attention of our amateurs to the circumstance, with a request that those who were possessed of suitable telescopes should watch the next transit of the third satellite on the 8th of the same month. One observer attempted to carry out the suggestion, but was unsuccessful owing to atmospheric causes. I was, however, more fortunate, for the satellite was again observed by me to transit its primary as a black spot on the 8th of April and 14th of May. Very full notes, with sketches, were taken during the transits. I determined pretty accurately the time when the satellite began to assume the dark appearance. The following observations were made:—

	Local Mean Time.			
	d	h	m	s
First contact at ingress	April 8	11	5	15
Bisection at ingress	„	11	8	15
Last contact at ingress	„	11	10	45
Satellite hardly distinguishable . . .	„	11	20	13
Satellite quite undistinguishable . . .	„	11	26	13
Beginning of dark phase	„	11	38	7
First contact at ingress	May 14	6	10	20
Last contact at ingress	„	6	16	20
Satellite visible as a very faint luminous spot	„	6	23	20
Satellite quite undistinguishable . . .	„	6	27	20
Beginning of dark phase	„	6	46	40

By "beginning of dark phase" is to be understood the instant when the satellite first became perceptible as a faint dark spot. Its darkness increased gradually in intensity on both occasions, till at length the satellite became as black as the ordinary shadows in transit.

It appears from communications by Messrs. Denning and Roberts to the *Astronomical Register* and the *Monthly Notices* respectively, that the same phenomenon was observed in connexion with the transit of the fourth satellite on the 26th of March last.

Observatory, Windsor, N. S. Wales,
1873, *August* 14.

Nebulæ discovered and observed at the Observatory of Marseilles. By M. Stéphan.

(*Communicated by M. Stéphan through Mr. Hind.*)

Mean R.A. and N.P.D. for 1873·0

No.	R.A. h	m	s	N.P.D. °	′	″	Comparison-Star.
1	2	8	55·19	61	59	25·2	*a*
2	18	23	38·27	67	10	21·1	*b*
3	18	41	18·79	57	51	8·7	*c*
4	19	51	32·23	57	58	58·9	*d*
5	21	9	53·99	91	21	14·8	*e*
6	22	9	50·36	53	21	13·9	*f*
7	22	10	7·11	53	20	12·1	*f*
8	22	45	11·42	53	35	8·6	*g*
9	22	47	22·35	58	32	39·3	*h*
10	22	55	55·98	63	37	55·2	*i*
11	23	16	6·70	78	48	5·5	*k*
12	23	16	26·36	78	42	43·4	*k*
13	23	32	33·54	102	55	37·0	*l*
14	23	38	59·16	63	23	9·5	*m*
15	23	51	34·73	74	12	39·4	*n*

Notes.

1. Exceedingly small and faint; irregular.
2. Very small and faint; round, with a condensation in the centre.
3. Of moderate extent and of irregular form; exceedingly faint and diffused.
4. Very small and exceedingly faint; surrounds three small stars.
5. Very small and exceedingly faint; this nebula has two condensations on the same parallel. The observation refers to the first point of condensation.
6. Exceedingly small and faint; in contact in the N. with a very small star.
7. Very small and faint; vaporous, with a slight condensation in the centre; a small star projecting.
8. Very small and exceedingly faint; round, with a condensation in the centre.
9. Vaporous; very small and exceedingly faint.
10. Exceedingly small and faint, with a condensation in the centre.
11. Small and exceedingly faint; roundish, but of irregular form; diffused, with a slight condensation in the centre.
12. Irregularly round, of moderate extent; faint and diffused, with a slight condensation in the centre.
13. Exceedingly faint and of moderate extent; irregular.
14. Very faint and minute; roundish, with an excentric condensation.
15. Exceedingly small and faint, with a condensation in the centre.

Mean R.A. and N.P.D. of the Comparison-Stars for 1873·0.

	Name of Star.	Mag.	R.A. h m s	N.P.D. ° ′ ″	Authority.
a	B.A.C. 710	6½	2 11 36·01	61 56 41·7	B.A.C.
b	Lalande 34322	7½	18 26 7·80	67 6 13·0	Lalande.
c	W. B. (2) XVIII. 1221	9	18 40 55·62	57 49 50·8	W. B. (2).
d	W. B. (2) XIX. 1790	8·9	19 55 1·50	57 54 28·0	W. B. (2).
e	W. B. (1) XXI. 131	8·9	21 8 8·57	91 21 25·1	W. B. (1).
f	W. B. (2) XXII. 253	9	22 11 17·04	53 24 9·1	W. B. (2).
g	Lalande 44751	9	22 45 56·17	53 36 27·2	Lalande.
h	W. B. (2) XXII. 1135	9	22 49 56·87	58 32 22·8	W. B. (2).
i	Rümker XXII. 10797	...	22 55 3·47	63 41 6·8	Rümker.
k	W. B. (1) XXIII. 597	9	23 20 56·69	78 45 50·3	W. B. (1).
l	W. B. (1) XXIII. 618	9	23 31 6·68	102 54 15·9	W. B. (1).
m	W. B. (2) XXIII. 868	8	23 41 13·62	63 31 33·9	W. B. (2).
n	W. B. (1) XXIII. 1133	9	23 55 54·18	74 16 46·8	W. B. (1).

Elements of Tempel's Comet of July 3 (*Comet* II., 1873).

By Mr. W. E. Plummer.

(*Communicated by Mr. Bishop.*)

The following elements are computed from the observations made at Clinton, U.S. and Ann Arbor on July 5, at Marseilles on August 30, and at Twickenham on October 20. All small corrections are taken into account and the Marseilles observation is represented within the errors:—

C−O	
$d\,l \cos b$	″ −4·2
$d\,b$	0·0

T June 25·377714 G.M.T.

	°	′	″	
π	306	9	43·15	M. eq. 1873·0
Ω	120	54	9·06	
i	12	43	20·20	
ϕ	32	58	1·20	

log. a	0·4697541
log. μ	2·8453752
Period	1850 days.

The Observatory, Twickenham,
1873, *December* 9.

Supplementary List of Co-ordinates of Stars within or near the Milky Way. By A. Marth, Esq.

(*Communicated by Mr. Lassell.*)

I enclose a "Supplementary List of Co-ordinates of Stars within or near the *Milky Way*," giving the places of a number of leading stars not contained in the lists published in the *Monthly Notices* for November 1872 and June 1873, so as to give to the whole zone one uniform breadth of 40 instead of only 30 degrees, and to include only those portions of the *Milky Way*, which, according to Heis's *Atlas Coelestis Novus*, extend beyond this zone. I have added at the end the data for tracing in the map the course of some of the arches of the sphere, which may be wanted. For, though not intended to be inserted in a finished drawing of the *Milky Way*, it may for some purposes be useful to have them inserted in the preparatory maps:—

x in.	*y* in.	Mag.	Star.	B.A.C.
0·20	7·79	5·3	57 Aquilæ	6822
0·51	−0·29	2	α Ophiuchi	5941
1·34	2·70	5·3	...	wanting
·53	1·83	6	...	wanting
·88	0·42	5	93 Herculis	6094
1·99	7·79	3	θ Aquilæ	6934
2·61	1·73	5·7	...	wanting
·70	0·51	5	101 Herculis	6159
·71	0·17	5	96 „	6110
·84	0·07	4·7	95 „	6106
2·84	0·44	4·3	102 „	6157
3·45	3·29	5·3	...	wanting
3·77	−1·04	3·3	μ Herculis	6021
4·28	−0·69	3·7	ξ „	6084
·36	−0·26	4	ο „	6150
·48	−0·73	4·3	ν „	6087
·63	+0·28	5	ι „	6238
·70	−0·41	5	b „	6147
·72	7·75	5	κ Delphini	7141
·96	2·11	6	...	wanting
4·96	0·28	5	A Herculis	6178
5·90	4·21	5·3	...	wanting
5·91	−1·29	4	θ Herculis	6082

x in.	y in.	Mag.	Star.	B.A.C.
6·02	−0·32	4·7	κ Lyræ	6235
·66	4·78	6	20 Vulpeculæ	6944
6·78	−0·41	5	μ Lyræ	6268
7·00	4·08	6	...	wanting
·38	6·10	5·3	30 Vulpeculæ	7188
·41	3·85	6	...	wanting
7·72	8·11	4·3	1 Pegasi	7418
8·12	0·34	var.	R Lyræ	6475
·15	5·05	5·3	48 Cygni	7131
·48	1·32	5·7	...	6656
·57	7·82	4·7	2 Pegasi	7474
·74	−1·11	5	...	6255
8·79	+0·30	5·3	16 Lyræ	6520
9·05	−1·99	2·3	γ Draconis	6091
·38	+7·98	4	κ Pegasi	7571
·42	−0·24	5·3	...	6470
·47	−0·01	5·3	..	wanting
·55	−0·91	5·3	...	6350
9·73	6·52	6	...	7465
10·18	7·44	5	14 Pegasi	7607
·24	0·24	4	κ Cygni	6623
·30	−0·85	5·3	ε Draconis	6395
·33	1·75	5·3	ε Cygni	6895
·38	5·78	5	70 „	7462
·54	−1·20	5	δ Draconis	6348
·86	−1·51	5	β „	6289
10·95	+3·80	5·3	60 Cygni	7306
11·05	−0·19	5·3	54 Draconis	6601
·15	+2·78	5·3	51 Cygni	7182
·18	−0·86	4·7	ο Draconis	6463
11·51	3·15	5·7	...	7294
12·21	2·98	6	...	7365
·39	5·44	5·7	...	7681
·57	3·48	6	...	7483
12·72	−0·62	5	π Draconis	6662
13·07	−0·90	3	δ „	6612
·52	−0·05	5	ρ „	6926
·62	−0·70	5·3	σ „	6735
·85	−0·49	3·7	■ „	6836

x in.	y in.	Mag.	Star.	B.A.C.
13·99	1·53	5·3	6 Cephei	7428
14·41	5·65	5·7	...	7999
15·07	−0·38	5·3	73 Draconis	7156
·33	+5·04	6	...	8107
·45	−0·88	4·3	κ Cephei	7005
·66	+0·74	5·3	16 „	7686
15·84	5·77	5·7	18 Andromedæ	8231
16·02	2·31	5·3	...	8039
·09	3·38	5·7	4 Cassiopeiæ	8162
·36	2·24	5·3	o Cephei	8124
16·39	0·48	5·3	...	7881
17·11	3·23	5·7	10 Cassiopeiæ	8373
·23	−0·67	5	34 H. Cephei	7990
·78	8·24	5·3	32 Andromedæ	173
·85	6·03	4·7	ξ Cassiopeiæ	180
17·89	6·72	5	π „	189
18·00	1·16	5·7	23 „	206
·05	−1·74	2	α Ursæ Minoris	360
·05	−1·12	4·3	43 H. Cephei	262
·15	3·91	5·3	...	239
·43	8·42	4	μ Andromedæ	259
·75	1·44	5·3	40 Cassiopeiæ	468
18·95	0·76	5·7	49 „	608
19·04	8·96	2·3	β Andromedæ	334
·19	4·17	5·3	χ Cassiopeiæ	456
19·54	−0·65	5·3	49 H. Cephei	1211
20·16	7·79	5·3	τ Andromedæ	502
20·63	4·47	5·3	i Persei	721
21·42	8·01	5·3	58 Andromedæ	649
21·67	8·54	3	β Trianguli	656
22·97	7·27	4·7	16 Persei	871
23·34	7·82	5	17 „	877
23·61	7·65	5·3	24 „	915
24·21	0·18	5·3	31 Camelopardali	1849
24·44	7·38	5	23 H. Persei	1017
25·00	0·55	5	ξ Aurigæ	1854
26·63	0·27	5·3	46 ψ' „	2044
·70	8·28	4·3	17 Tauri	1147
·87	8·16	4	27 „	1176

x in.	y in.	Mag.	Star.	B.A.C.
26·96	7·10	5·3	41 Tauri	1262
27·71	7·95	4·7	A ,,	1257
27·81	0·07	5·3	55 ψ^4 Aurigæ	2182
28·15	0·36	5·3	50 ψ^2 ,,	2159
28·46	0·02	5	58 ψ^7 ,,	2223
29·03	7·95	4	δ Tauri	1346
·06	7·81	5	68 ,,	1365
·24	8·31	4	γ ,,	1328
·48	7·95	4	θ^1 ,,	1380
·49	7·96	4	θ^2 ,,	1381
·50	7·85	5	...	1391
·62	8·18	5	π Tauri	1370
·83	7·90	5·3	ρ ,,	1409
·83	7·54	5	σ^2 ,,	1437
29·84	7·58		σ^1 ,,	1436
30·15	0·01	5·7	...	2314
·18	6·72	5·3	...	1526
·36	8·02	4·3	c Tauri	1434
·51	7·26	6	o^1 Orionis	1500
·75	7·19	5	o^2 ,,	1525
30·92	5·20	5	119 Tauri	1726
31·06	0·15	4·7	τ Geminorum	2340
·07	−0·68	4·7	ρ ,,	2464
·13	−0·91	1·7	α ,,	2485
·28	7·65	5	7 π^1 Orionis	1516
·36	7·97	4·7	2 π^2 ,,	1491
·67	8·22	3·7	1 π^3 ,,	1486
·80	−0·25	4	ι Geminorum	2442
·81	−0·42	5·3	b^1 ,,	2467
·86	−0·42	5	b^2 ,,	2469
·90	−1·04	5	σ ,,	2540
31·96	+8·32	4·3	3 π^4 Orionis	1495
32·11	−1·07	1·3	β Geminorum	2555
·11	+5·09	5·3	133 Tauri	1834
·18	−0·61	4·3	υ Geminorum	2493
·30	+0·07	5·7	A ,,	2431
·62	8·55	4	8 π^5 Orionis	1514
·84	−0·76	3·7	κ Geminorum	2551
32·87	8·45	4·7	10 π^6 Orionis	1538

x in.	y in.	Mag.	Star.	B.A.C.
33·03	6·64	5·3	A Orionis	1722
·09	7·70	5	ρ „	1611
·23	7·23	5·3	m „	1665
·42	7·11	5	ψ „	1700
·59	7·33	5	25 „	1685
33·91	7·69	5	o „	1660
34·04	−0·35	5·3	g Geminorum	2558
·25	7·41	5·3	31 Orionis	1717
·40	8·76	3	β Eridani	1588
34·99	8·51	4	τ Orionis	1638
35·17	8·77	1	β „	1623
·34	8·33	5	e „	1680
·44	7·93	5	v „	1731
35·60	7·62	5·3	d „	1785
36·56	−0·96	3·7	β Cancri	2778
47·77	−0·23	4	α Antliæ	3578

Co-ordinates for tracing the course of the Equator, of the Ecliptic, and of the Parallels of 30° and 60° Decl.

Equator.			Ecliptic.		
x in.	y in.	x in.	x in.	y in.	x in.
68·88	−1	39·12	33·83	−1	63·26
69·57	0	38·43	33·09	0	63·99
70·22	+1	37·78	32·41	+1	64·67
70·83	2	37·17	31·77	2	65·32
71·42	3	36·58	31·15	3	65·94
0·00	4	36·00	30·54	4	66·54
0·58	5	35·42	29·94	5	67·15
1·17	6	34·83	29·32	6	67·77
1·78	7	34·22	28·67	7	68·41
2·43	8	33·57	27·99	8	69·09
3·12	9	32·88	27·26	9	69·83

30° N. Decl.			30° S. Decl.		
x in.	y in.	x in.	x in.	y in.	x in.
4·32	−1	31·68	49·00	−1	59·00
4·77	0	31·23	47·11	0	60·89
5·26	+1	30·74	45·76	+1	62·24
5·80	2	30·20	44·70	2	63·30
6·39	3	29·61	43·81	3	64·19

30° N. Decl.			30° S. Decl.		
x in.	*y* in.	*x* in.	*x* in.	*y* in.	*x* in.
7·05	4	28·95	43·05	4	64·95
7·81	5	28·19	42·39	5	65·61
8·70	6	27·30	41·80	6	66·20
9·76	7	26·24	41·26	7	66·74
11·11	8	24·89	40·77	8	67·23
13·00	9	23·00	40·32	9	67·68

60° N. Decl.			60° S. Decl.		
x in.	*y* in.	*x* in.	*x* in.	*y* in.	*x* in.
11·31	−1	24·69	54	4·00	54
11·73	0	24·27	53	4·08	55
12·34	+1·00	23·66	52	4·31	56
13·00	1·79	23·00	51	4·71	57
14	2·68	22	50	5·32	58
15	3·29	21	49·00	6·21	59·00
16	3·69	20	48·34	7·00	59·66
17	3·92	19	47·73	8	60·27
18	4·00	18	47·31	8	60·69

Correction: Vol. XXXIII., page 11, *x* 21·50 read *y* 1·74 instead of 1·44. (in. in.)

On a Spectroscopic Observation of a Meteor.

By Herr Nicolas de Konkoly.

(*Communicated by Mr. Browning.*)

On the evening of the 13th of October, my assistant told me there was a long star in the N.E. I came on the platform of my observatory and saw the track of this meteor. I did not see the full length of the track, because there was a great cloud, extending to 15°.

The streak of light the meteor left behind was bright enough to enable me to analyse it with a spectroscope—it was nearly 15′ broad. I applied the excellent meteor-spectroscope made by Browning, and saw very finely the bands of sodium and magnesium.

I found the streak of light with the star-spectroscope made by Browning applied to my refractor, and analysed with it the fading light of the track of the meteor; with this telescope, armed with the spectroscope, I saw the bright lines of sodium and magnesium, and two lines in the red and two in the green.

I observed with the instrument several tubes made by Geissler in connection with a Ruhmkorf coil, and I found that the spectrum of the lightning gas in the Geissler tubes was absolutely coincident with these last four bands.

I had eleven minutes to make this observation. After eleven minutes had elapsed, I could not make observations with the instrument, but I could still see the bands of magnesium very finely with the meteor-spectroscope. The last trace of the meteor track I saw at the expiration of 25 minutes in a comet-finder of Steinheil's.

The meteor probably fell to the earth, but I saw a light in the horizon at 50 miles off, and it may have fallen on a house or a combustible object. I have written letters of inquiry in the direction, but I have not yet received any answer. If I should receive an answer containing information, I will go to the place, and make inquiries, with particulars for publication.

O' Gyalla Observatory, Hungary,
1873, *October* 17.

Post-perihelion Places of Coggia's Comet. By J. R. Hind, Esq.

The following positions of this comet for the latter half of December are derived from elements communicated by Professor E. Weiss, to the Vienna Academy, on November 20:—

At Greenwich, Noon.

1873-4	R.A. h	m	s	Decl. °	′	Log. Δ
Dec. 16	13	32	4	−43	7	9·7482
20	13	33	0	45	7	9·7906
24	13	35	0	46	48	9·8274
28	13	37	8	48	14	9·8594
Jan. 1	13	40	9	−49	28	9·8873

It will be remarked that, as regards position, there would be no difficulty in observing the comet in the Southern Hemisphere, but its faintness may be such, that the only hope of procuring places will be from telegraphing its position and direction of motion on some date during the absence of moonlight to Mr. Ellery, who might then, with the Melbourne reflector, furnish the means for deciding as to identity or otherwise with the comet of February 1818. The observations in this hemisphere extend over too short an interval to be adequate to this purpose. If the period be really as conjectured, about 55 years, the comet must make a close approach to the orbit of *Venus* near the descending node.

Parabolic Elements of the Comet, 1743-4. By Mr. W. E. Plummer.

(*Communicated by Mr. Bishop.*)

The following calculations have all been based upon the reduction of the original observations by Mr. Hind, published in the *Astronomische Nachrichten.* I have likewise adopted the positions of the Sun which Mr. Hind has calculated from Carlini's latest Solar Tables. The difference between Carlini and Le Verrier for that time is very slight.

By using Maraldi's observation of 1743, December 21; Bradley's of 1744, January 24; and the mean of Bradley's and Bliss's observations on February 28, a preliminary orbit was obtained, which served for the corrections of parallax and aberration, and supplied the means of obtaining normal places. It is a curious fact connected with this calculation, that the first approximation to the proportion of the curtate distances of the comet at the first and third observations gave a negative result.

ELEMENTS I.

T 1744, March 1·34370 Paris M.T.

	°	′	″	
π	197	11	43·8	} M. eq. 1744·0.
Ω	45	45	18·3	
i	47	2	55·9	

log. q 9·3467620

Motion direct.

The error of the ephemeris computed from these elements on January 24 was

	C−O				C−O		
	′	″			′	″	
R.A.	+1	25·9		Decl.	−1	1·3,	

with which ephemeris all the observations collected by Mr. Hind were compared. It is unnecessary to give the individual comparisons. The errors were grouped into six combinations, which showed that the ephemeris required the following corrections:—

Paris M.T.	R.A.		Decl.	
	′	″	′	″
1743, Dec. 27·5	−0	48·0	+0	20·4
1744, Jan. 8·5	−1	42·3	+0	44·7
Jan. 21·5	−2	11·2	+0	51·7
Jan. 31·5	−1	36·2	+1	17·1
Feb. 15·0	−1	43·8	+0	29·3
Feb. 29·0	−0	19·1	+0	20·0

For these times 12 equations of condition were formed, which it is hardly necessary to give here; and the application of the method of least squares showed that the necessary corrections to Elements I. were

dT	+	0·0025815	
dq	−	0·0000007	
		′	″
$d\pi$	+	0	4·3
$d\Omega$	−	0	25·4
di	+	4	22·7

and therefore the improved elements are as follow:—

ELEMENTS II.

T March 1·3462815 Paris M.T.

	°	′	″	
π	197	11	48·1	M. eq. 1744·0
Ω	45	44	52·9	
i	47	7	18·6	

log. q 9·3467607

Motion direct.

A comparison with the six normal places exhibits the following errors:—

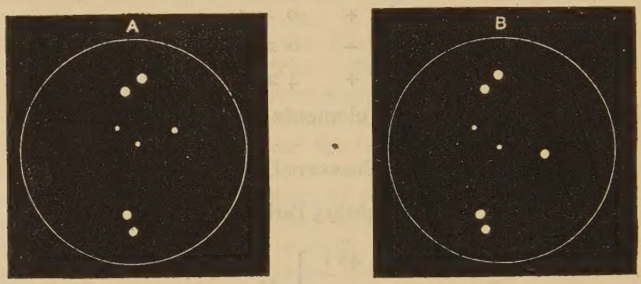
	$d\lambda \cos\beta$	$d\beta$
	″	″
Dec. 27	+19·9	+36·2
Jan. 8	− 5·5	+10·1
Jan. 21	−20·3	−25·0
Jan. 31	+21·6	−20·9
Feb. 15	−34·7	− 6·4
Feb. 29	+21·2	+ 0·1

The Observatory, Twickenham,
1873, *December* 10.

On the Position and Magnitude of the Stars between ε and 5 Lyræ. By C. L. Prince, Esq.

Considerable increase of brilliancy is observable in the largest of the three stars which lie between the two pairs of this asterism. There has been, also, great alteration in the relative position of these stars with respect to the principal components. Admiral Smyth, in his remarks respecting this group, says (*Celestial Cycle*, vol. II., page 428), "Between these pairs and *two thirds* over

from ε towards 5, are three small stars forming a curve to the south." The following diagram (A) is the one he has given for 1842 epoch, and (B) is one which I made a few evenings since, from which it appears that the central acolyte is more nearly midway between the two pairs than formerly, while the largest forms, with them, very nearly, the apex of a triangle.



The Observatory, Crowborough Beacon,
1873, *December* 9.

If the relative positions and magnitudes of the stars in this interesting group are really changed from those depicted in the *Celestial Cycle*, as pointed out by Mr. Prince, it will be highly important that the fact be confirmed by a set of careful measures of the angular distances and positions of the three intermediate stars with reference to ε and 5 *Lyræ*.—[Editor.]

Note by the Astronomer Royal.

In my paper "On the rejection, in the Lunar Theory, of the term of longitude depending for argument on eight times the mean longitude of *Venus* minus thirteen times the mean longitude of the Earth, &c.," inserted in the last number of the *Monthly Notices*, I omitted to allude to Professor Newcomb's valuable paper, "Considerations on the Apparent Inequalities of Long Periods, &c," which contains remarks on the same subject. The observations, however, to which references are made, and the general modes of treatment, are essentially different, and the two papers may be regarded as absolutely independent.

1873, *December* 8.

Professor Newcomb's Tables of Uranus.

It was announced at the last Meeting of the Society that Professor Newcomb's important investigation on the orbit of *Uranus* has been published. It contains a full explanation of the theory of the motion of that planet, together with a well-arranged series of Tables for the calculation of the tabular places. Although a copy of this valuable work has not yet reached the Society, yet we have seen one specially sent to the Astronomer Royal by the author. Before, however, the publication of the Tables, they have been adopted in the calculation of the tabular places of *Uranus* contained in the American *Nautical Almanac* for 1876; and through the kindness of Professor Newcomb, Mr. Hind has been enabled to give the places of *Uranus* in the *Nautical Almanac* for 1877, also derived from the new Tables. From the known care taken by Professor Newcomb in the preliminary investigations, in which he has used the meridional observations of *Uranus* made at Greenwich and Washington down to the opposition of 1871-2, we may confidently anticipate that the new Tables will represent the orbital motion of the planet with a great degree of accuracy.

We may remark here that Professor Newcomb's Tables of *Neptune*, during the few years they have been adopted in the *Nautical Almanac* calculations, have almost perfectly represented the motion of that planet. The observed errors of the Tabular R.A. and N.P.D. are at the present time very small indeed, being no greater than the separate accidental errors found in the observed positions of the fundamental stars.

ERRATA.

Vol. XXXIII. page 169, line 19, *for* 22° 10′ 27″·29 *read* 22h. 10m. 27s·29.

„ „ 347, „ 34, *for* α Geminorum *read* ε Geminorum.

„ „ 490, „ 491, „ 492, In heading, 'Year of Observation,' *for* 1871 *read* 1873.

Vol. XXXIV. „ 1, line 14 from bottom, *for* page 583 *read* page 533.

„ „ 31, „ 9, *for* 5° *read* 5″.